

CLAIM AMENDMENTS

Claim Amendment Summary

Claims pending

- At time of the Action: Claims 1-61.
- After this Response: Claims 1, 2, 4-7, 9, 10, 12, 13, 15, 16, 18-24, 32, 34, 35, 37, 38, 40, 41-43, 47-48, 51, 52, 54, and 56-61.

Canceled or Withdrawn claims: 3, 8, 11, 14, 17, 25-31, 33, 36, 39, 44-46, 49-50, 53, and 55.

Amended claims: 1, 2, 4, 6, 7, 9, 10, 13, 15, 16, 18, 19, 34, 35, 37, 38, 40, 41, 51, 52, and 54.

New claims: none.

Claims:

1. (CURRENTLY AMENDED) A method of determining language usage probabilities of a natural language based upon a training corpus, the method comprising:

examining a training corpus, wherein such corpus includes phrases parsed in accordance with a set of grammar rules;

computing probabilities of usage of combinations of linguistic features based upon empirical tracking of appearances of instances of such combinations in phrases within the training corpus;

wherein the combinations of linguistic features consist of:

- (transition, headword, phrase level, syntactic history, segtype):

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- (headword, phrase level, syntactic history, segtype);
- (modifying headword, transition, headword); or
- (transition, headword).

2. **(CURRENTLY AMENDED)** A method of determining language usage probabilities of a natural language based upon a training corpus, the method comprising:

examining a training corpus, wherein such corpus includes phrases parsed in accordance with a set of grammar rules;

computing probabilities of usage of combinations of linguistic features based upon empirical tracking of appearances of instances of such combinations in phrases within the training corpus;

~~A method as recited in claim 1,~~ wherein the combinations of linguistic features comprises:

- (transition, headword, phrase level, syntactic history, segtype);
- (headword, phrase level, syntactic history, segtype);
- (modifying headword, transition, headword); and
- (transition, headword).

3. **(CANCELED)**

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1 4. (CURRENTLY AMENDED) ~~A method as recited in claim 1, A~~
2 method of determining language usage probabilities of a natural language based
3 upon a training corpus, the method comprising:

4 examining a training corpus, wherein such corpus includes phrases parsed
5 in accordance with a set of grammar rules;

6 computing probabilities of usage of combinations of linguistic features
7 based upon empirical tracking of appearances of instances of such combinations in
8 phrases within the training corpus, wherein the computing comprises counting
9 appearances of instances of combinations of linguistic features within the training
10 corpus.

11
12 5. (ORIGINAL) A computer-readable storage medium having
13 computer-executable instructions that, when executed by a computer, performs the
14 method as recited in claim 1.

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1 6. (CURRENTLY AMENDED) A method for determining a probability
2 at a node in a parse tree, the method comprising:

3 receiving language-usage probabilities based upon appearances of instances
4 of combinations of linguistic features within a training corpus;

5 calculating the probability at the node based upon linguistic features of the
6 node and the language-usage probabilities;

7 wherein the combinations of linguistic features consist of:

- 8 • (transition, headword, phrase level, syntactic history, segtype);
- 9 • (headword, phrase level, syntactic history, segtype);
- 10 • (modifying headword, transition, headword); or
- 11 • (transition, headword).

12
13 7. (CURRENTLY AMENDED) A method for determining a probability
14 at a node in a parse tree, the method comprising:

15 receiving language-usage probabilities based upon appearances of instances
16 of combinations of linguistic features within a training corpus;

17 calculating the probability at the node based upon linguistic features of the
18 node and the language-usage probabilities;

19 ~~A method as recited in claim 6, wherein the combinations of linguistic~~
20 ~~features comprises:~~

- 21 • (transition, headword, phrase level, syntactic history, segtype);
- 22 • (headword, phrase level, syntactic history, segtype);
- 23 • (modifying headword, transition, headword); and
- 24 • (transition, headword).

1 8. (CANCELED)

2
3 9. (CURRENTLY AMENDED) A method for determining a probability
4 at a node in a parse tree, the method comprising:

5 receiving language-usage probabilities based upon appearances of instances
6 of combinations of linguistic features within a training corpus;

7 calculating the probability at the node based upon linguistic features of the
8 node and the language-usage probabilities. A method as recited in claim 6,
9 wherein the calculating comprises using PredParamRule Probability formula to
10 calculate the probability at the node.

11
12 10. (CURRENTLY AMENDED) A method for determining a probability
13 at a node in a parse tree, the method comprising:

14 receiving language-usage probabilities based upon appearances of instances
15 of combinations of linguistic features within a training corpus;

16 calculating the probability at the node based upon linguistic features of the
17 node and the language-usage probabilities. A method as recited in claim 6,
18 wherein the calculating comprises using both PredParamRule Probability and
19 SynBigram Probability formulas to calculate the probability at the node.

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21 11. (CANCELED)

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1 **12. (ORIGINAL)** A computer-readable storage medium having
2 computer-executable instructions that, when executed by a computer, performs the
3 method as recited in claim 6.

4
5 **13. (CURRENTLY AMENDED)** A method for determining a statistical
6 goodness measure (SGM) of a parse tree representing a parse of a phrase, the
7 parse tree comprising one or more nodes, the method comprising:

8 combining probabilities of each node in the parse tree, wherein the
9 probabilities of each node are determined by the steps comprising:

10 receiving language-usage probabilities based upon appearances of
11 instances of combinations of linguistic features within a training corpus;

12 calculating the probabilities of each node based upon linguistic
13 features of each node and the language-usage probabilities;

14 wherein the combinations of linguistic features comprises:

- 15 • (transition, headword, phrase level, syntactic history, segtype);
- 16 • (headword, phrase level, syntactic history, segtype);
- 17 • (modifying headword, transition, headword); and
- 18 • (transition, headword).

19
20 **14. (CANCELED)**

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15. (CURRENTLY AMENDED) A method for determining a statistical goodness measure (SGM) of a parse tree representing a parse of a phrase, the parse tree comprising one or more nodes, the method comprising:

combining probabilities of each node in the parse tree, wherein the probabilities of each node are determined by the steps comprising:

receiving language-usage probabilities based upon appearances of instances of combinations of linguistic features within a training corpus;

calculating the probabilities of each node based upon linguistic features of each node and the language-usage probabilities. A method as recited in claim 13, wherein the calculating comprises using PredParamRule Probability formula to calculate the probability at the node.

16. (CURRENTLY AMENDED) A method for determining a statistical goodness measure (SGM) of a parse tree representing a parse of a phrase, the parse tree comprising one or more nodes, the method comprising:

combining probabilities of each node in the parse tree, wherein the probabilities of each node are determined by the steps comprising:

receiving language-usage probabilities based upon appearances of instances of combinations of linguistic features within a training corpus;

calculating the probabilities of each node based upon linguistic features of each node and the language-usage probabilities. A method as recited in claim 13, wherein the calculating comprises using both PredParamRule Probability and SynBigram Probability formulas to calculate the probability at the node.

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1 17. (CANCELED)

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3 18. (CURRENTLY AMENDED) A method for determining statistical
4 goodness measures (SGMs) of multiple parse trees, each tree representing a
5 syntactically valid parse of a phrase, the method comprising determining a SGM
6 of each parse tree ~~by the method as recited in claim 13~~ a method comprising:

7 combining probabilities of each node in the parse tree, wherein the
8 probabilities of each node are determined by the steps comprising:

9 receiving language-usage probabilities based upon appearances of
10 instances of combinations of linguistic features within a training corpus;

11 calculating the probabilities of each node based upon linguistic
12 features of each node and the language-usage probabilities.

13
14 19. (CURRENTLY AMENDED) A method for ranking multiple parse
15 trees, each tree representing a syntactically valid parse of a phrase, the method
16 comprising:

17 determining statistical goodness measures (SGMs) of each parse tree by a
18 statistical goodness measure (SGM) method ~~the method as recited in claim 13~~ to
19 get an SGM values associated with each tree;

20 organizing the trees in order of each tree's associated SGM value;

21 the SGM method comprising:

22 combining probabilities of each node in the parse tree, wherein the
23 probabilities of each node are determined by the steps comprising:

24
25 Serial No.: 09/620,745

Attr Docket No.: MS1-5431US

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Att'y: Kasey C. Christie

- receiving language-usage probabilities based upon appearances of instances of combinations of linguistic features within a training corpus;
- calculating the probabilities of each node based upon linguistic features of each node and the language-usage probabilities.

20. (ORIGINAL) A computer-readable storage medium having computer-executable instructions that, when executed by a computer, performs the method as recited in claim 13.

21. (ORIGINAL) A method of parsing a phrase to facilitate processing of such phrase by a computer, the method comprising:

generating at least one parse tree representing a syntactically valid parse of the phrase, wherein the parse tree has hierarchical nodes;

dividing each node into one or more hierarchical phrase levels, wherein the phrase levels at a node represent a set of possible transitions from such node that are allowed by a set of grammar rules.

22. (ORIGINAL) A method as recited in claim 21, wherein the set of possible transitions from each node consists of all possible transitions from such node that are allowed by a set of grammar rules.

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1 23. (ORIGINAL) A method as recited in claim 21, wherein the set of
2 possible transitions from each node includes a null transition representing an
3 application of none of the grammar rules.

4
5 24. (ORIGINAL) A computer-readable storage medium having
6 computer-executable instructions that, when executed by a computer, performs the
7 method as recited in claim 21.

8
9 25. (CANCELED)

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11 26. (CANCELED)

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13 27. (CANCELED)

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15 28. (CANCELED)

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17 29. (CANCELED)

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19 30. (CANCELED)

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21 31. (CANCELED)

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1 **32. (ORIGINAL)** A computer-readable storage medium having
2 computer-executable instructions that, when executed by a computer, perform a
3 method to rank multiple parse trees, each tree representing a syntactically valid
4 parse of a phrase, the method comprising:

5 generating at least one parse tree representing a syntactically valid parse of
6 the phrase, wherein the parse tree has hierarchical nodes;

7 dividing each node into one or more hierarchical phrase levels, wherein the
8 phrase levels at a node represent a set of possible transitions from such node that
9 are allowed by a set of grammar rules.

10
11 **33. (CANCELED)**

12
13 **34. (CURRENTLY AMENDED)** An apparatus comprising:

14 a processor;

15 a natural-language-usage probability determiner executable on the
16 processor to:

17 examine a training corpus, wherein such corpus includes phrases
18 parsed in accordance with a set of grammar rules;

19 compute probabilities of usage of combinations of linguistic features
20 based upon empirical tracking of appearances of instances of such
21 combinations in phrases within the training corpus;

22 wherein the combinations of linguistic features consist of:

- 23 • (transition, headword, phrase level, syntactic history,
24 segtype);
- 25 • (headword, phrase level, syntactic history, segtype);

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Atty Docket No.: MS1-543US
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atty: Kasey C. Christie

- (modifying headword, transition, headword); or
- (transition, headword).

35. (CURRENTLY AMENDED) An apparatus comprising:

a processor;

a natural-language-usage probability determiner executable on the processor to:

examine a training corpus, wherein such corpus includes phrases parsed in accordance with a set of grammar rules;

compute probabilities of usage of combinations of linguistic features based upon empirical tracking of appearances of instances of such combinations in phrases within the training corpus;

An apparatus as recited in claim 34, wherein the combinations of linguistic features comprises:

- (transition, headword, phrase level, syntactic history, segtype);
- (headword, phrase level, syntactic history, segtype);
- (modifying headword, transition, headword); and
- (transition, headword).

36. (CANCELED)

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1 **37. (CURRENTLY AMENDED)** An apparatus comprising:

2 a processor;

3 a natural-language-usage probability determiner executable on the
4 processor to:

5 receive language-usage probabilities based upon appearances of
6 instances of combinations of linguistic features within a training corpus;

7 calculate a probability at a node in a parse tree based upon linguistic
8 features of the node and the language-usage probabilities;

9 wherein the combinations of linguistic features consist of:

- 10 • (transition, headword, phrase level, syntactic history,
11 segtype);
- 12 • (headword, phrase level, syntactic history, segtype);
- 13 • (modifying headword, transition, headword); or
- 14 • (transition, headword).

15
16 **38. (CURRENTLY AMENDED)** An apparatus comprising:

17 a processor;

18 a natural-language-usage probability determiner executable on the
19 processor to:

20 receive language-usage probabilities based upon appearances of
21 instances of combinations of linguistic features within a training corpus;

22 calculate a probability at a node in a parse tree based upon linguistic
23 features of the node and the language-usage probabilities;

24 ~~An apparatus as recited in claim 37, wherein the combinations of linguistic~~
25 features comprises:

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atty: Kasey C. Christie

- (transition, headword, phrase level, syntactic history, segtype);
- (headword, phrase level, syntactic history, segtype);
- (modifying headword, transition, headword); and
- (transition, headword).

39. (CANCELED)

40. (CURRENTLY AMENDED) An apparatus comprising:

a processor;

a natural-language-usage probability determiner executable on the processor to:

receive language-usage probabilities based upon appearances of instances of combinations of linguistic features within a training corpus;

calculate a probability at a node in a parse tree based upon linguistic features of the node and the language-usage probabilities;

An apparatus as recited in claim 37, wherein the determiner calculates the probability at the node by using PredParamRule Probability formula.

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1 **41. (CURRENTLY AMENDED)** An apparatus comprising:

2 a processor;

3 a natural-language-usage probability determiner executable on the
4 processor to:

5 receive language-usage probabilities based upon appearances of
6 instances of combinations of linguistic features within a training corpus;

7 calculate a probability at a node in a parse tree based upon linguistic
8 features of the node and the language-usage probabilities;

9 ~~An apparatus as recited in claim 37,~~ wherein the determiner calculates the
10 probability at the node by using both PredParamRule Probability and SynBigram
11 Probability formulas.

12
13 **42. (ORIGINAL)** An apparatus comprising:

14 a processor;

15 a natural-language-usage parser executable on the processor to:

16 generate at least one parse tree representing a syntactically valid parse of
17 the phrase, wherein the parse tree has hierarchical nodes;

18 divide each node into one or more hierarchical phrase levels,
19 wherein the phrase levels at a node represent a set of possible transitions
20 from such node that are allowed by a set of grammar rules.

21
22 **43. (ORIGINAL)** An apparatus as recited in claim 42, wherein the set of
23 possible transitions from each node includes a null transition representing an
24 application of none of the grammar rules.

1 **44. (CANCELED)**

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3 **45. (CANCELED)**

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5 **46. (CANCELED)**

6
7 **47. (ORIGINAL)** A data structure for use with a computer having a
8 processor and a memory, said structure comprising:

9 a corpus comprising one or more phrases in a natural language;

10 parse trees having hierarchical nodes, each tree representing at least one
11 syntactically valid parse of each phrase in a subset of the corpus;

12 wherein each node has one or more hierarchical phrase levels, wherein the
13 phrase levels at a node represent a set of possible transitions from such node that
14 are allowed by a set of grammar rules.

15
16 **48. (ORIGINAL)** The structure as recited in claim 47, wherein the subset
17 of the corpus includes all phrases in the corpus.

18
19 **49. (CANCELED)**

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21 **50. (CANCELED)**

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1 **51. (CURRENTLY AMENDED)** A data structure for use with a computer
2 having a processor and a memory, said structure comprising:

3 a corpus comprising one or more phrases in a natural language;

4 parse trees having hierarchical nodes, each tree representing at least one
5 syntactically valid parse of each phrase in a subset of the corpus;

6 wherein each node as an associated probability, wherein the associated
7 probability of a node is based upon linguistic features of such node and language-
8 usage probabilities derived from appearances of instances of combinations of
9 linguistic features within a training corpus;

10 wherein PredParamRule Probability formula is used to calculate a
11 probability associated with a node.

12
13 **52. (CURRENTLY AMENDED)** A data structure for use with a computer
14 having a processor and a memory, said structure comprising:

15 a corpus comprising one or more phrases in a natural language;

16 parse trees having hierarchical nodes, each tree representing at least one
17 syntactically valid parse of each phrase in a subset of the corpus;

18 wherein each node as an associated probability, wherein the associated
19 probability of a node is based upon linguistic features of such node and language-
20 usage probabilities derived from appearances of instances of combinations of
21 linguistic features within a training corpus;

22 ~~A method as recited in claim 51,~~ wherein the combinations of linguistic
23 features comprises:

- 24 • (transition, headword, phrase level, syntactic history, segtype);
25 • (headword, phrase level, syntactic history, segtype);

- (modifying headword, transition, headword); and
- (transition, headword).

53. (CANCELED)

54. (CURRENTLY AMENDED) A data structure for use with a computer having a processor and a memory, said structure comprising:
a corpus comprising one or more phrases in a natural language;
parse trees having hierarchical nodes, each tree representing at least one syntactically valid parse of each phrase in a subset of the corpus;
wherein each node as an associated probability, wherein the associated probability of a node is based upon linguistic features of such node and language-usage probabilities derived from appearances of instances of combinations of linguistic features within a training corpus;

~~A method as recited in claim 51, wherein both PredParamRule Probability and SynBigram Probability formulas are used to calculate a probability associated with a node.~~

55. (CANCELED)

56. (ORIGINAL) A program module for execution on a computing operating environment having a memory, the module comprising:
a natural language phrase parser configured to generate one or more syntactically valid parses for a phrase, each parse may be represented by a parse tree having hierarchical nodes;

1 a parse ranker configured to calculate a SGM for each parse of a phrase and
2 to rank the parses to indicate a most probable parse;

3 wherein the parse ranker comprises:

4 data-acquisition device for receiving language-usage probabilities
5 based upon appearances of instances of combinations of linguistic features
6 within a training corpus;

7 probability calculator for calculating a probability at a node of a
8 parse tree based upon linguistic features of the node and the language-usage
9 probabilities.

10
11 57. (ORIGINAL) A natural language processing system comprising a
12 program module as recited in claim 56.

13
14 58. (ORIGINAL) A grammar checking system comprising a program
15 module as recited in claim 56.

16
17 59. (ORIGINAL) A speech processing system comprising a program
18 module as recited in claim 56.

19
20 60. (ORIGINAL) A database query processing system comprising a
21 program module as recited in claim 56.

22
23 61. (ORIGINAL) An operating system comprising a program module as
24 recited in claim 56.